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(56) Documents Cited
GB 2326707 A
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US 4366858 A
GB 1253940 A
EP 0068529 A1
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(54) Abstract Title
A heat exchanger and tank unit

(57) A heat exchanger header and tank unit (particularly for an automotive air conditioning condenser) comprises an integrated header and a tank defined by a dividing piece provided internally of a casing of the unit. A communication pass permits fluid communication between the header and the tank. The communication pass may comprise an aperture formed through the width of the dividing piece.

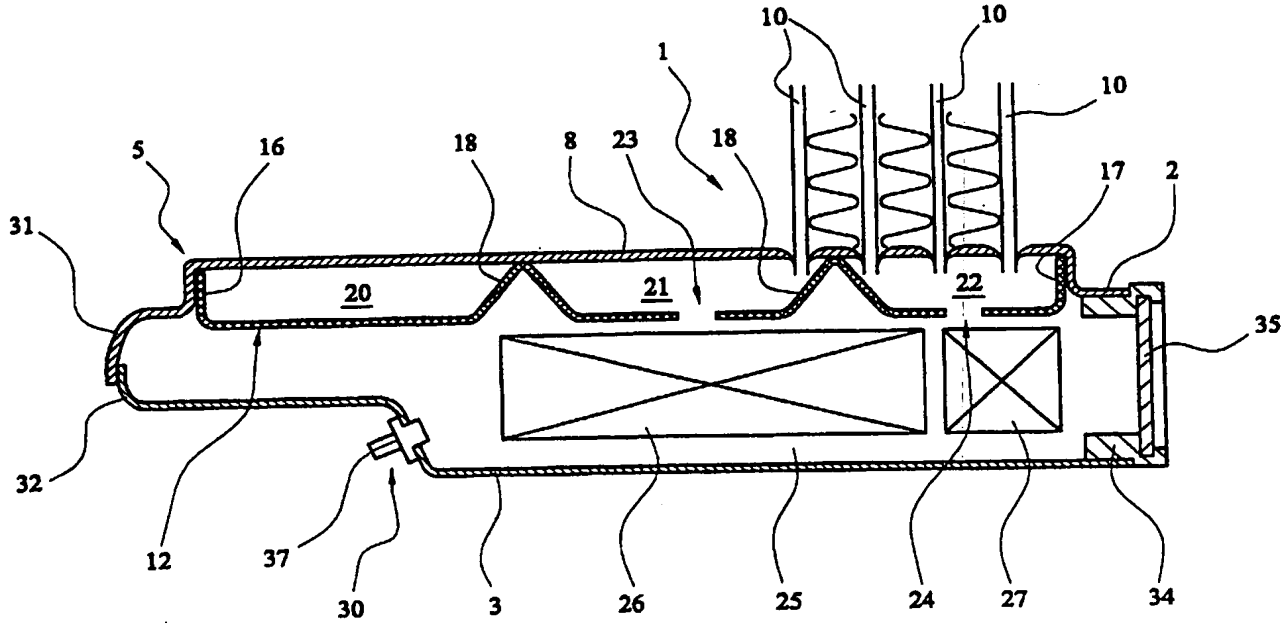

FIG. 3

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At least one drawing originally filed was informal and the print reproduced here is taken from a later filed formal copy.

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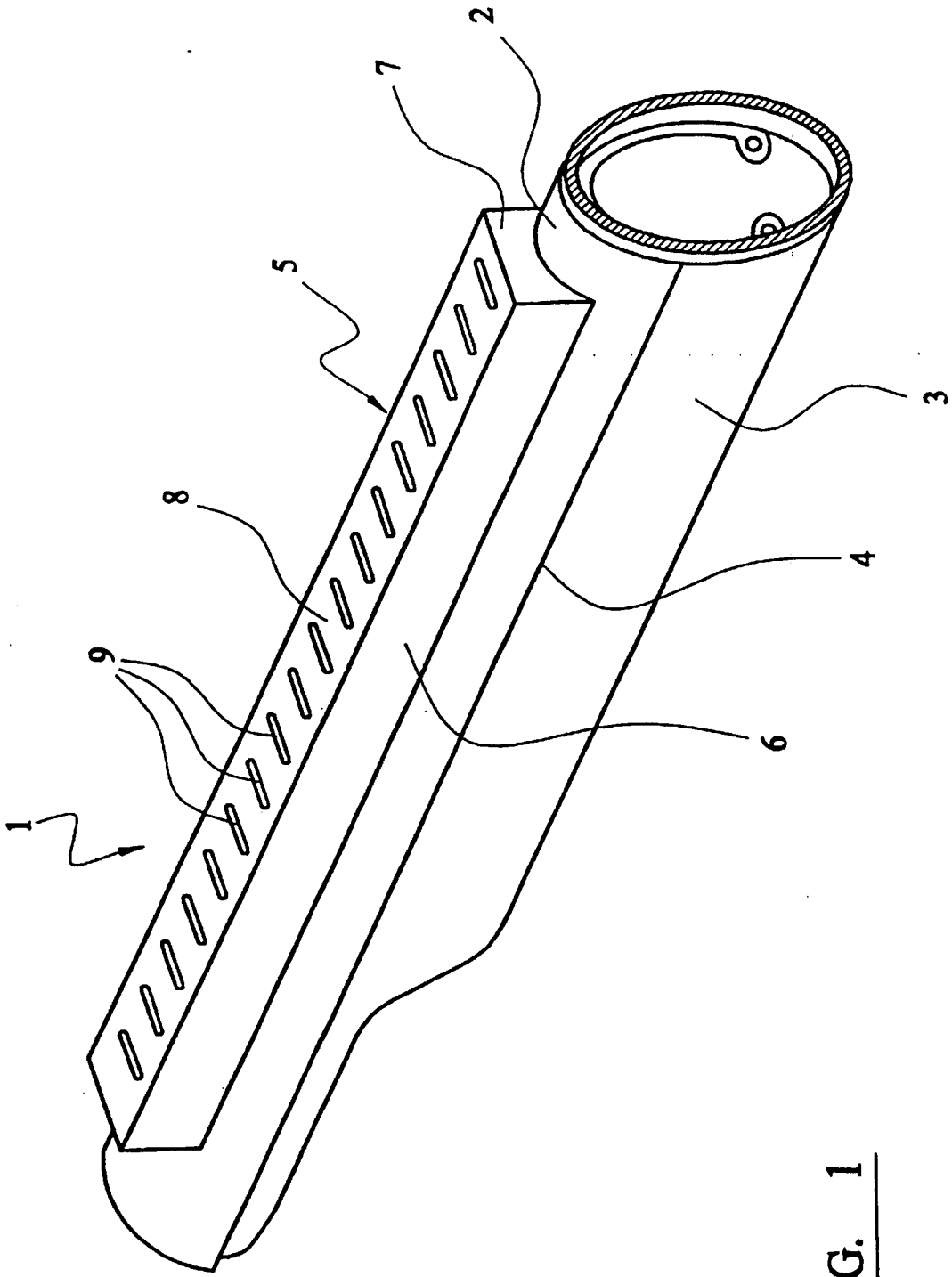

FIG. 1

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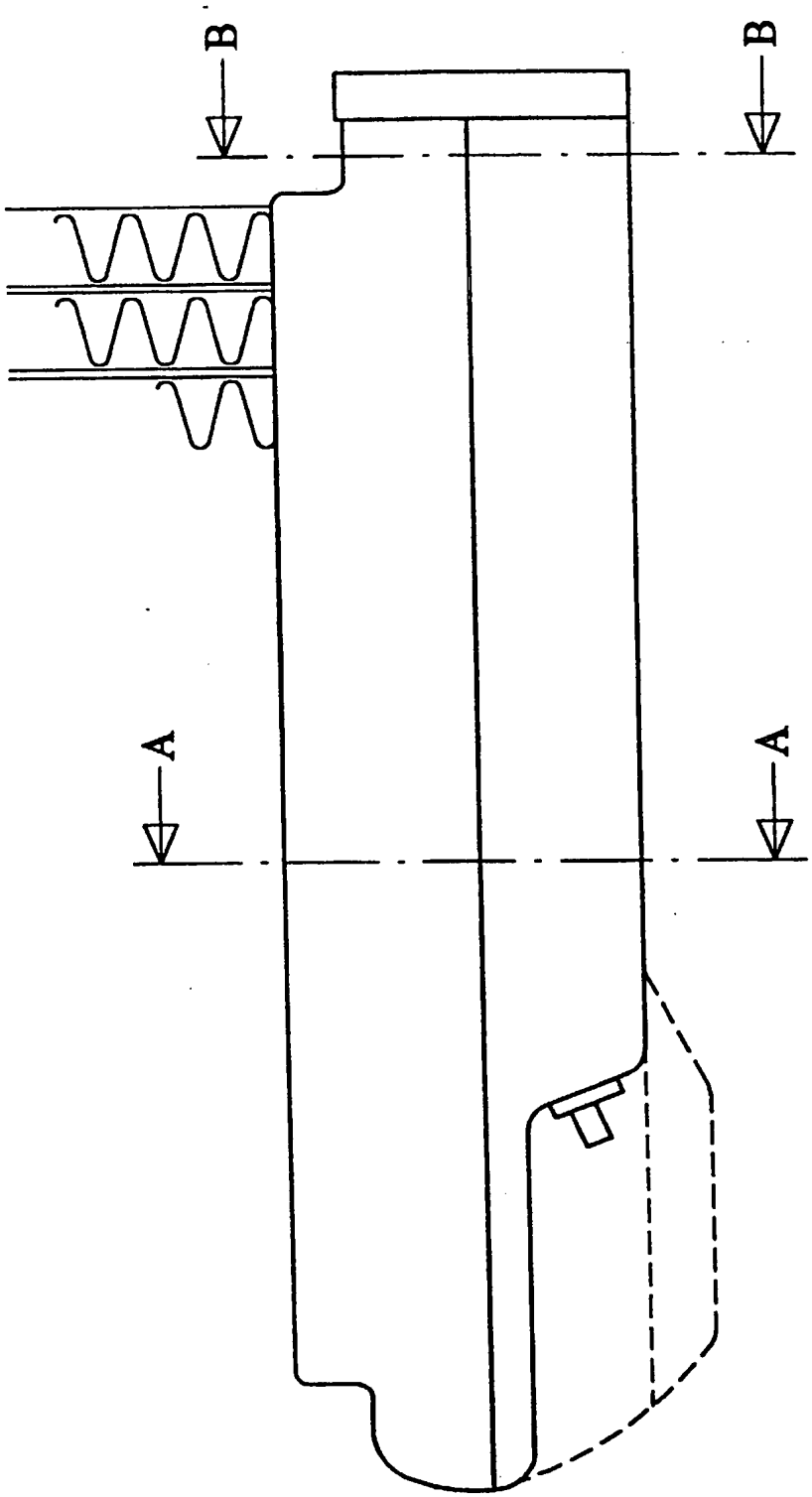

FIG. 2

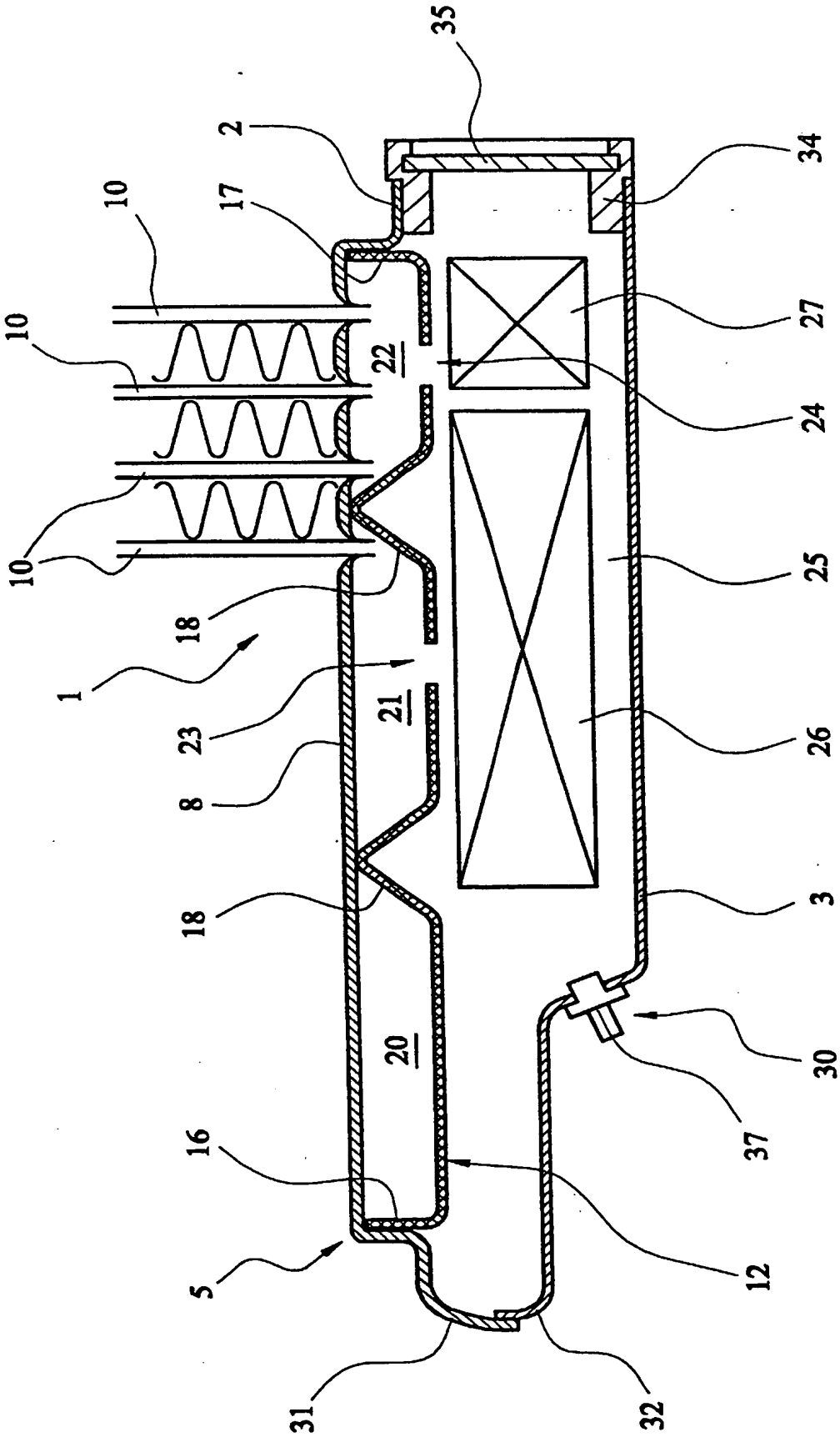

FIG. 3

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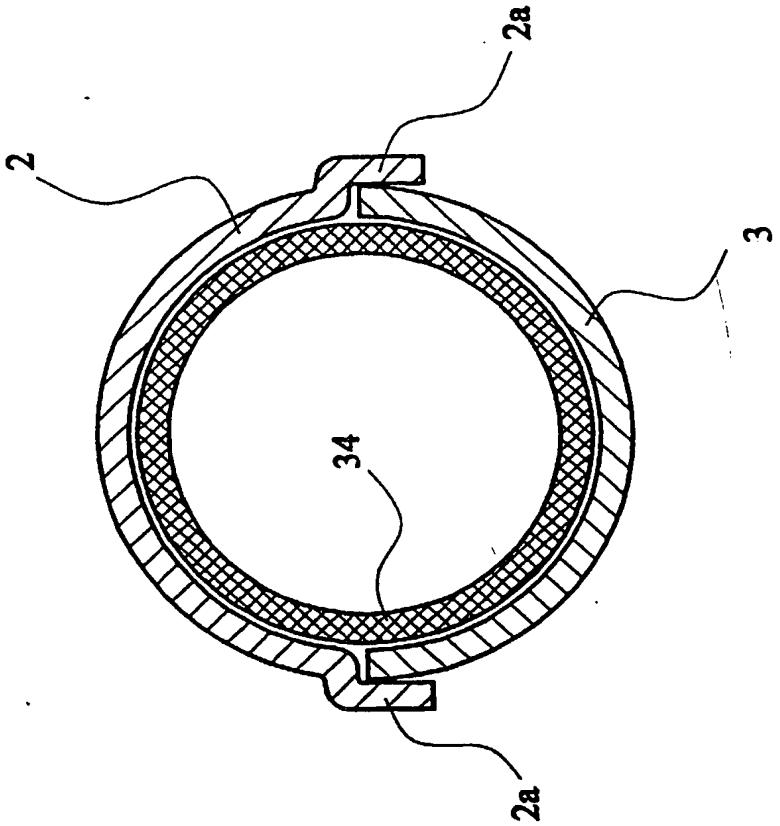

FIG. 5

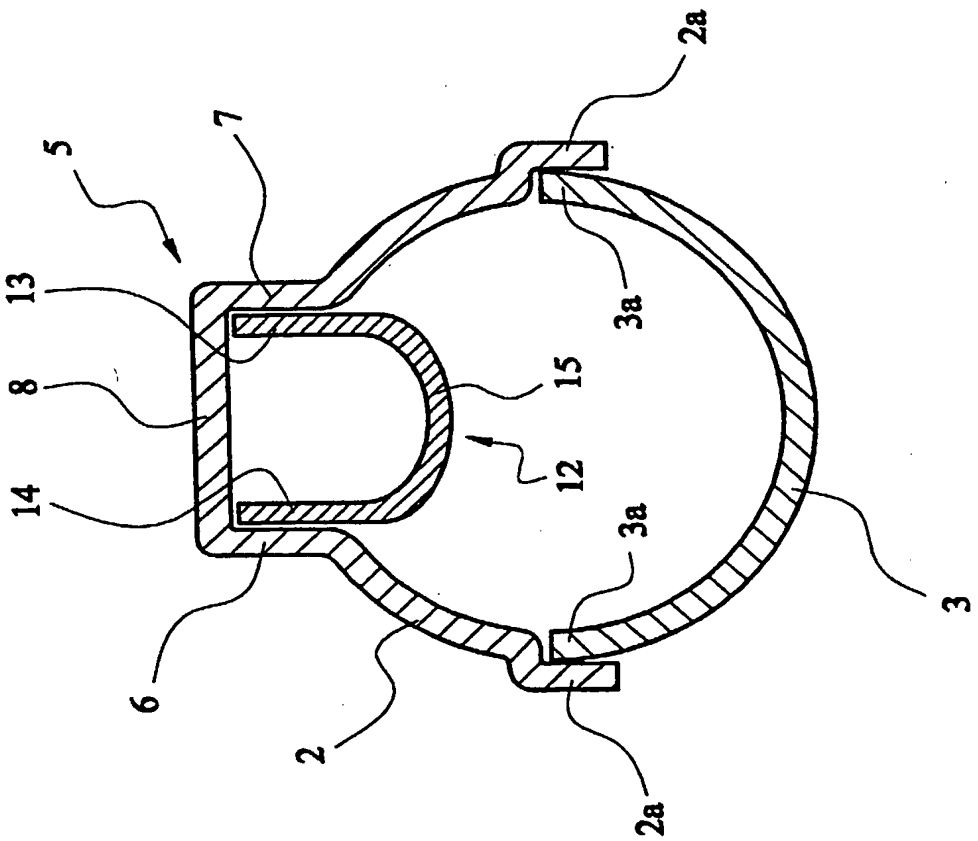

FIG. 4

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A Heat Exchanger Header and Tank Unit

The present invention relates to a heat exchanger header and tank unit, and particularly to such a unit for incorporation in condensers for use in automotive air conditioning systems.

Traditionally for heat exchangers used in automotive applications (such as refrigerant condensers for use in automotive air conditioning systems) associated overflow/expansion tanks, where required, have taken the form of tanks separate from the heat exchanger header, located downstream of the heat exchanger and connected by hoses or the like. An example of such an arrangement is a so called receiver/drier positioned downstream of a condenser in an air conditioning system. US-A-5546761 discloses a condenser for automotive air conditioning apparatus in which a condenser header and liquid tank (receiver drier) are fabricated to be connected to one another.

An improved arrangement has now been devised.

According to the invention, there is provided a heat exchanger header and tank unit comprising a header zone and a tank zone, the header zone and tank zones being defined by a dividing element provided internally of a casing of the unit, a communication pass permitting fluid communication between the header zone and the tank zone.

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The development of a combined header and tank unit in accordance with the invention provides advantages in reducing the overall weight, size (packaging envelope) and number of parts when compared to prior art arrangements. The assembly process is simplified. A reduced size and performance compressor can therefore be used.

The communication pass preferably permits fluid to pass across the dividing element between the header zone and the tank zone, preferably comprising an aperture formed through the width of the dividing element. A plurality of passes may be provided between respective zones of the tank zone and the header zone.

The dividing element preferably includes one or more baffle portions inhibiting fluid flow between spaced header zone portions. The baffle portions define contra-flow sections of the heat exchanger permitting the heat exchange fluid in the heat exchange tubes of the exchanger to make multiple passes across the heat exchanger. In contra flow sections the flow in the tubes across the heat exchanger is in opposed directions. The baffle portion is beneficially integrally formed with the dividing element (preferably in a pressing operation). The baffle portion preferably comprises a wall section formed as an apex or crest. The baffle portion is preferably contiguous with an internal surface of the casing of the unit.

The dividing element beneficially includes opposed sidewalls and a spanning portion, the sidewalls extending adjacent wall portions of the internal surface of the unit

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casing. This facilitates bonding between the dividing element and the casing which will typically be achieved by brazing where the respective components are of aluminium.

The dividing element is preferably configured, with or without the unit casing, to provide a longitudinally extending header including one or more header zones having opposed closed ends. The dividing element is preferably of smaller (thinner) gauge material than the material of the casing. This provides weight (and cost) benefits.

The unit casing beneficially includes a series of apertures or openings for receiving the terminal portions of a respective plurality of heat exchange tubes, the openings or apertures preferably being defined through a surface of the casing in a proud standing portion of the casing. The proud standing portion of the casing defines, internally of the casing, a recess within which the dividing element is capable of being at least partially received.

The unit casing is desirably of two or more piece construction. This enables the dividing piece to be fitted in position and the casing pieces subsequently assembled. Casing pieces are preferably joined/bonded (for example brazed) at a seam extending in the longitudinal direction of the unit. The unit casing preferably includes a first trough casing piece and a second trough casing piece, the first and second trough casing pieces fitted together along respective edges. One of the casing pieces beneficially includes a shoulder or step adjacent its terminal edge for accommodating the terminal edge of the

other casing piece in edge overlapping relationship. This enables the pieces to be mated together for bonding (brazing). Alternatively fold over tabs or the like may be provided for the casing pieces and dividing element to enable the arrangement to be held in an assembled state ready for bonding/brazing, typically in a one-shot process. this technique is known in the art.

The casing pieces are preferably configured to define a closed end for the unit. The casing pieces are configured to define an opening at one end of the unit which opening is closed by an end cap. The opening permits other components such as desiccant products or filters to be introduced into the casing. Typically the opening will communicate into the tank zone portion of the unit.

The tank zone may vary in cross sectional area at longitudinally spaced positions. This permits larger or lesser volumes of condensed refrigerant to be accommodated. In such an arrangement, the tank zone may include a step zone connecting zones of different cross sectional area.

A desiccant product may be disposed in the tank zone in order to absorb any water moisture.

A filter may be disposed in the tank zone.

At least a portion of the unit casing preferably comprises a pressed aluminium component. The unit casing preferably comprises a plurality of aluminium components brazed together. The dividing element is preferably of aluminium

and brazed to an aluminium portion of the unit casing.

The unit is particularly beneficial for use in automotive air conditioning systems.

According to a further aspect, there is provided a method of manufacturing a heat exchanger header and tank unit,

particularly when manufacturing a condenser for automotive use, the method comprising assembling a dividing element with a first casing piece to define one of a header zone and a tank zone, and assembling a second casing piece with the first casing piece to define the other of a tank zone and a header zone; the divider and first casing piece and the first and second casing pieces being bonded together.

The invention will now be further described for a specific embodiment, by way of example only with reference to the accompanying drawings in which:

Figure 1 is a perspective view of a heat exchanger header and tank unit according to the invention;

Figure 2 is a side view of the unit of Figure 1;

Figure 3 is a schematic sectional view along the length of the unit of the preceding figures;

Figure 4 is a sectional view along A-A in Figure 2; and

Figure 5 is a sectional view along B-B in Figure 2.

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Referring to the drawings there is shown an integrated header and tank unit 1, for a condenser for use in an automotive air conditioning system.

The header and tank unit 1, comprises a first casing shell 2, and second casing shell 3, both of aluminium and brazed along a longitudinally running seam 4. Both aluminium casing shells 2, are pressed components, shell 2 being pressed to have a projecting header formation 5, comprising projecting spaced walls 6,7, and a spanning portion 8. Spanning portion 8 is provided with a series of spaced aperture plungings 9. Aperture plungings 9 are shaped and dimensioned to accept the refrigerant containing tubes 10 of the condenser, which are also of aluminium and brazed at the point of entry into the header. Casing shell 2 has an outwardly deflected edge defining a shoulder and permitting overlap of the casing edges 2a, 3a at the brazed seam 4. (This is shown most clearly in Figures 4 and 5.)

As is most clearly shown in Figure 3, internally of the casing, an aluminium divider 12 received and brazed within the internal recess defined by the projecting header formation 5. Divider 12 comprises spaced longitudinally running side walls 13,14, connected by spanning portion 15, and longitudinally opposed end walls 16,17. The divider 12 is a pressed opponent including transverse pressed crest portions 18, the apexes of which are brazed to the internal wall of the projecting header wall 8, of casing shell 2. There is brazed connection between the casing of the header projection 5 and divider 12 along the adjacently running

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side walls 13,14, 6,7 crests 18, and wall of header casing portion 8, and also between end wall 16,17, of the divider 12, and the corresponding end wall portions of the header projection 8. In an alternative embodiment, the divider 12 could be simply a flat elongate strip pressed to form the crest portions 18 and brazed to traverse spaced walls 6, 7 opposite spanning portion 8 of header formation 5. This dispenses with the need for sidewalls 13, 14 and makes for a lighter, lower cost product.

In this arrangement spaced header zones 20,21,22 are defined, each in communication with end of specific sets of heat exchange tubes 10. In reality, in Figure 3 and Figure 2 the heat exchanger tubes 10, are spaced along the entire length of the header and tank unit 1. The spaced header zones 20,21,22 provide for refrigerant flow across the condenser in multi-pass fashion, the flow of refrigerant in tubes connected with the spaced header zones 20,21,22 being in opposed directions. Spaced communication apertures 23,24 are provided through the divider 12 permitting condensed refrigerant to pass into the tank portion 25 of the unit. The tank portion 25 acts as a receiver/drier component, collecting the condensed refrigerant and passing the refrigerant through a desiccant sack 26 (to remove water moisture) and filter 27 (to remove unwanted debris).

Casing shell 3 defining the outer wall of the tank 25, can be shaped as required to accommodate different volumes of refrigerant as required for a particular technical application. In the arrangement shown in Figures 1,2 and

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3, the casing 3, includes a step region 30, between a zone of relatively large tank volume per unit length and a zone of relatively small tank volume per unit length. Alternatively, as shown by the dashed lines in Figure 2, the step portion can be used to step to a zone of increased volume per unit length relative to the volume per unit length defined by the majority of the casing.

The casing shells 2,3 have closure lips to define a brazed sealed end at one end of the unit. At the other end of the unit, the casing shells 2,3 define an opening within which collar 34 is fitted and subsequently a sealing cap and clip 35 used to seal the unit. Because the casing shells are pressed components, shoulders and other formations can be provided for ease of mounting within the vehicle and/or for positioning components of the condenser/receiver drier. For example, a pressure switch 37 may be accommodated on a press formed shoulder.

The unit is typically assembled with the condenser as a whole to be brazed in a 'one-shot' brazing process. During assembly, divider 12 is stationed in the internal recess defined by the header projection 5, either by being a push fit or by the use of clips or tabs (which may be provided on one or either of the components). The casing shells 2,3 are then brought together and held (again typically by overlapping tabs provided on the casing shells 2,3). This type of component securing ready for brazing is already known in the art. An open end to the casing is defined, into which a collar 34 is fitted, and the assembly brazed. Collar 34 includes an opening through which desiccant sack

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25 and filter 27 can be inserted, positioned and secured within the tank 25 (following brazing). The open end is then closed by sealing cap and clip 35.

Significant advantages of the invention are that:

1. The overall number of parts is greatly reduced viz a viz prior art non-integrated arrangements.
2. Material weight is reduced, decreasing costs.
3. The majority of the assembly is made from pressed parts, thereby minimising costs.
4. Assembly time/number of operations is reduced.
5. The packaging envelope is reduced in size.
6. The volume of liquid can be optimised for a particular application.

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Claims:

1. A heat exchanger header and tank unit comprising a header zone and a tank zone, the header zone and tank zones being defined by a dividing element provided internally of a casing of the unit, a communication pass permitting fluid communication between the header zone and the tank zone.

2. A unit according to claim 1, wherein the communication pass permits fluid to pass across the dividing element between the header zone and the tank zone.

3. A unit according to claim 1 or claim 2, wherein the communication pass comprises an aperture formed through the width of the dividing element.

4. A unit according to any preceding claim, wherein a plurality of passes are provided between respective zones of the tank zone and the header zone.

5. A unit according to any preceding claim, wherein the dividing element has one or more baffle portions inhibiting fluid flow between spaced header zones.

6. A unit according to claim 5, wherein the baffle portion is integrally formed with the dividing element.

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7. A unit according to claim 6, wherein the baffle portion comprises a wall section formed as an apex or crest.

8. A unit according to claim 7, wherein the apex or crest is contiguous with an internal surface of the casing of the unit.

9. A unit according to any preceding claim, wherein the dividing element has opposed sidewalls and a spanning portion, the sidewalls extending adjacent wall portions of the internal surface of the unit casing.

10. A unit according to any preceding claim, wherein the dividing element is bonded to the internal surface of the casing of the unit.

11. A unit according to any preceding claim, wherein the dividing element is configured, with or without the unit casing, to provide a longitudinally extending header including one or more header zones having opposed closed ends.

12. A unit according to any preceding claim, wherein the unit casing includes a plurality of apertures or openings for receiving the terminal portions of a respective plurality of heat exchange tubes.

13. A unit according to claim 12, wherein a series of apertures or openings for the heat exchange tubes are defined through a surface of the casing in a proud standing portion of the casing.

14. A unit according to claim 13, wherein the proud standing portion of the casing defines, internally of the casing, a recess within which the dividing element is at least partially received.

15. A unit according to any preceding claim, wherein the unit casing is of two or more piece construction.

16. A unit according to claim 15, wherein pieces of the casing are joined at a seam extending in the longitudinal direction of the unit.

17. A unit according to any preceding claim, wherein the unit casing has a first trough casing piece and a second trough casing piece, the first and second trough casing pieces fitted together along respective free edges.

18. A unit according to claim 17, wherein one of the casing pieces includes a shoulder or step adjacent its terminal edge for accommodating the terminal edge of the other casing piece in edge overlapping relationship.

19. A unit according to claim 17 or claim 18, wherein the casing pieces are configured to define a closed end for the unit.

20. A unit according to any of claims 17 to 19, wherein casing pieces are configured to define an opening which opening is closed by an end cap.

21. A unit according to any preceding claim, wherein the tank zone varies in cross sectional area at longitudinally spaced positions.

22. A unit according to claim 21, wherein the tank zone includes a step zone connecting zones of different cross sectional area.

23. A unit according to any preceding claim, wherein a desiccant product is disposed in the tank zone.

24. A unit according to any preceding claim, wherein a filter is disposed in the tank zone.

25. A unit according to any preceding claim, wherein at least a portion of the unit casing comprises a pressed aluminium component.

26. A unit according to any preceding claim, wherein the unit casing comprises a plurality of aluminium components brazed together.

27. A unit according to any preceding claim, wherein the dividing element is of aluminium and brazed to an aluminium portion of the unit casing.

28. A unit substantially as herein described with reference to the accompanying drawings.

29. A heat exchanger incorporating a combined header and tank unit according to any preceding claim.

30. A condenser for use in automotive air conditioning systems, the condenser incorporating a combined header and tank unit according to any preceding claim.

31. A method of manufacturing a heat exchanger header and tank unit, particularly when manufacturing a condenser for automotive use, the method comprising assembling a dividing element with a first casing piece to define one of a header zone and a tank zone, and assembling a second casing piece with the first casing piece to define the other of a tank zone and a header zone; the divider and first casing piece and the first and second casing pieces being bonded together.

32. A method of manufacturing a heat exchanger header and tank unit, particularly when manufacturing a condenser for automotive use, substantially as herein described with reference to the accompanying drawings.

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INVESTOR IN PEOPLE

Application No: GB 0021346.2 **Examiner:** Mark Lewney
Claims searched: All **Date of search:** 14 March 2001

Patents Act 1977
Search Report under Section 17

Databases searched:

UK Patent Office collections, including GB, EP, WO & US patent specifications, in:

UK Cl (Ed.S): F4H (HG17), F4S (S8)

Int Cl (Ed.7): F28F (9/00), (9/02)

Other: ONLINE: WPI, EPODOC, JAPIO.

Documents considered to be relevant:

Category	Identity of document and relevant passage		Relevant to claims
X	GB2326707A	(PARTCO LIMITED) - Header tank divided by a partition (19), with a pass (23) allowing fluid communication.	1, 2, 9, 10, 31
X	GB1253940	(DAIMLER-BENZ) - Heat exchanger with a header tank (10) divided by a partition (7).	1, 2, 9, 10, 31
A	EP0825404A2	(CALSONIC CORPORATION) - Figures illustrate various forms of integral header/tank.	
X	EP0068529A1	(SHELL INTERNATIONAL RESEARCH) - See especially figs 3 and 4. Tubular header tank with separator chamber (11) divided by partition (22).	1, 2, 4, 9-12, 25, 31
X	US5228315A	(ZEXEL CORPORATION) - See especially figs. 10 and 11. Header tank comprising tank zone (17) and header zone (21) connected by a communication pass (40).	1, 2, 5, 9-12, 31

X	Document indicating lack of novelty or inventive step	A	Document indicating technological background and/or state of the art.
Y	Document indicating lack of inventive step if combined with one or more other documents of same category.	P	Document published on or after the declared priority date but before the filing date of this invention.
&	Member of the same patent family	E	Patent document published on or after, but with priority date earlier than, the filing date of this application.

Application No: GB 0021346.2
Claims searched: All

Examiner: Mark Lewney
Date of search: 14 March 2001

Category	Identity of document and relevant passage		Relevant to claims
X	US5088294A	(SANDEN CORPORATION) - Condenser including a partitioned header (31) and a communication pass (33).	1, 2, 9-11, 31
X	US4366858A	(MORANNE) - Outlet header tank with partition wall (7) containing an opening (13).	1, 2, 9, 10, 31

X	Document indicating lack of novelty or inventive step	A	Document indicating technological background and/or state of the art.
Y	Document indicating lack of inventive step if combined with one or more other documents of same category.	P	Document published on or after the declared priority date but before the filing date of this invention.
&	Member of the same patent family	E	Patent document published on or after, but with priority date earlier than, the filing date of this application.